# Alliance-based network view on Chinese firms' catching-up: case study of Huawei Technologies Co.Ltd


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# Alliance-based Network View on Chinese Firms' Catching-up: Case Study of Huawei Technologies Co.Ltd.[1]

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**Abstract**
With China's rapid economic growth in recent years, many Chinese firms especially in high-tech industries have started to technically lead in the international market. In this study, we aim to uncover the root causes that lead to Chinese firms' catching up from network perspective. By taking Huawei Technologies Co. Ltd. as a case, we integrate absorptive capacity development and firm-level catching up into an alliances-based network framework. We found that network alliances with firms and universities complement each other at different catching up stages; and alliances-based network provides a springboard for Chinese firms to shorten catching up path. We argue that in Chinese context, impact of FDI on firms' performance comes into effect only if partnership is carried out; alliances with universities facilitate development of absorptive capacity at an early stage; Partnering with leading players stimulate R&D investment at a late stage and simultaneously enhance firm's innovation performance as well.

**Key words**
Strategic alliances, Network, Chinese firms, absorptive capacity, catching up
**JEL Code:** M13, O32, O19, L24

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## 1. Introduction

The central idea of national catching up is the technologic and economic convergence between leading countries and followers (Abramotiz, 1986). Since 1960s, with the empirical studies of catching up experience of the US, Japan, and South Korea, this theory has been rapidly developed. Freeman (2002) argued that technology and innovation are central to the catching-up process; latecomer firms have advantage to target progressive and dynamic industries. Perez and Soete (1988) claim that once latecomer firms have enough time and sufficient productive capability as well as other resource endowment (especially human capital relevant for new technologies), catching up can be achieved through 'window of opportunity'.

As one of emerging economies, China's spectacular economic growth and unprecedented success have attracted much attention from both academic scholars and policy-makers alike. Undoubtedly, today's China has been the single most important new development affecting the world economy at the outset of the 21st century (Elchengreen and Tong, 2007). China's GDP has been the third largest country in the world after the US and Japan. China is now the world's sixth largest trader, supplying more than six per cent of global exports, and the leading destination of foreign direct investment.

With China's rapid development, many Chinese firms have already been the leading players in the international market. LUBS research report said that Chinese multinationals could no longer be regarded as 'apprentices' on the international stage; they have already been investing in the developed countries to obtain intellectual property and to learn from joint venture partners (LUBS report, Jan. 2009).

In the academic field, much attention has focused at macro-economic level on the impact of FDI on China's economic growth. In the early stage, inward FDI in China was extensively studied. Scholars made consensus that FDI significantly and positively impacted on China's industrialization as well as productivity (i.e. Kueh, 1992; Wang and Swain, 1995, Liu et al., 2001; Heid and Ries, 1996). Later on, as Chinese firms emerged as a strong group of foreign direct investors in other developed and developing countries, much research effort was switched to Chinese outward FDI and its impact on firm's development and other countries' economic growth (i.e. Elchengreen and Tong, 2007).

We found that fewer studies at micro-level have considered frameworks that lead to Chinese firms' catching up. Maybe it is because the number of successful catching up firms from China is not large. Child and Rodrigues (2005) have ever initiated an article aiming to stimulate discussion on this issue. However, as we can see, the studies are still very limited. Yu et al. (2006) gave the evidence that there have been a number of Chinese companies catching up. Duysters et al. (2009) argued in a case study of Haier Group that there is an alternative strategy for many Chinese firms to the much-acclaimed East-Asian route to growth. They all highlighted the importance of strategic alliances in the cases but unfortunately did not pay much attention to explore the catching up framework.

Therefore in this study, we seek to identify a framework that part of Chinese firms in ICT industry used for catching up. By taking Huawei Technologies Co. Ltd. as a case work, we try to find out the strategies that Chinese firms used for developing absorptive capacity and innovation performance.

Based on the case study of Huawei, we argue that FDI is inter-dependent with strategic alliances in the early stages of catching up and network alliances with universities and other firms effectively facilitate Chinese firm's development. We are not saying that this network perspective view on catching-up framework is suitable for all Chinese firms, but at least it provides other latecomer firms with a referred mechanism. We expect this study could stimulate more discussion on Chinese firms' catching up, catching up strategies, and catching up frameworks.

The study proceeds as follows. Firstly, a brief explanation of core concepts like strategic alliances and absorptive capacity is given in section 2. Afterwards, an overview of catching up in China's context is presented, including China's absorptive capacity at national level and Chinese firms' mode choice in a catching up trajectory. Then, section 4 focuses on the case study of Huawei Technologies Co.Ltd. from alliances-based network perspective; and finally we give the discussion, conclusion, and future research in section 5.

## 2. Core Concepts

### *2.1 Strategic Alliances*

In line with previous alliance research (Yoshino and Rangan, 1995; Osborn and Hagedoorn, 1997; De Man *et al*, 2001; Heimeriks, 2004), we define strategic alliances as *agreements between two or more partners as a cooperative form towards a common goal by sharing necessary resources as well as coordinating activities*.

Besides the advantages that collaboration encompasses such as flexibility, commitment reduction, and facilitating organizational learning etc. (Mowery et al.,1992; Chan, 1997) , strategic alliances have additionally advantages in offering opportunities to (a) access market; (b) accelerate the return on investment; (c) share the cost

of investment such as R&D; (d) spread risk; (e) access resources such as complementary technology; (f) create efficiencies through economies of scale and scope; (g) co-opt competition. ompanies using strategic alliances might gain an early window on emerging opportunities that they may want to commit to more fully in the future (Schilling and Steensma, 2001) and obtain overall level of flexibility by establishing a limited stake in a venture while maintaining the flexibility to either increase their commitment later or shift these resources to another opportunity (Schilling and Steensma, 2001)

### *2.2 Absorptive Capacity*

Cohen and Levinthal (1990) define absorptive capacity as a firm's general ability to value, assimilate, and commercialize new, external knoweldge. They argue that a firm's absorptive capacity is develped cumulatively, path dependent, and based on prior investments in its member's absorptive capacity.

In the school of absorptive capacity, many scholars explored internal determinants of absorptive capacity. Nicholls-Nixon (1993) examined the role of absorptive capacity in pharmaceutical firms' responsees to the technological discontinuity created by the emergence of biotechnology. She measured absorptive capacity in three ways: the number of biotechnology patents the firm held, the number of new products it had on the market or under development, and its reputation for expertise in the human healthier appalications of biotechnology. She found that firms with high levels of absorptive capacity invested more in their own R&D, utilizeed alliances, in-house expertise with relevant technologies, and communications with alliance partners.

Absorptive capacity of allainces partners are related to learning process. Lane and Lubakin (1998) argue that absorptive capacity is a function of the absorptive capacity of the dyad. Koza and Lewin (1998) address the importance of absorptive capacity by considering different type of alliances in terms of non-equity allainces (such as joint R&D, franchasing, and licensing) and equity alliances (such as joint venture). They propose that non-equity based exploration alliances are greater interdependent than equity based exploitation between absorptive capcity and learning of each partner.

## 3. Catching up Analysis in Chinese context

Based on a historical analysis, Mokyr (1990) argues that technology catching up is an outcome of a process of technology accumulation. Abramovitz (1989:222) argues that a country's potential for rapid growth is strong not when it is backward without qualification, but rather when it is technologically backward but *socially advanced.* In other words, *absorptive capacity can be established only if sufficient social capability has been built*. In the dynamic economic evolution, the potential for developing absorptive capacity at a basic level is not only associated with a country's endowment of high skilled labor but also closely related to the corresponding mechanism of open communication. Therefore, we argue that an embedded catching up system is developed within an individual-organization-society 'pyramid' in which absorptive capacity is built on social capability and catching up is generated when absorptive capacity and social capacity are prepared.

### *3.1 China's absorptive capacity at national level*

To measure China's national-level absorptive capacity, two indicators can be chosen. First is the *endowment of researchers* and the other is *the ratio of R&D investment over GDP*. According to the announcement from OECD in 2006, the number of researchers in China has increased over 77% from 1995 to 2005, China has ranked the second worldwide with 926 000 researchers by 2005, just behind the United States. Figure 1 gives the comparison across OESO, Netherlands, European Union Countries, and China on ratio of R&D investment over GDP. In order to identify the main characteristics of China's national absorptive capacity, the source of R&D expenses and the allocated distribution of R&D fund are also considered. From figure1 we can see China's investment in R&D over GDP was averagely above 1.05% per year; by 2006, this ratio had approached to 1.5%. According to the report submitted by National Development and Reform Commission to National People's Congress, China is aiming to raise spending on research and development up to 1.58 percent of GDP in 2009. These two indicators implicate that China's absorptive capacity at national level has been tremendously developed; measuring at a country level, the technology gap between China and European developed countries is getting smaller.

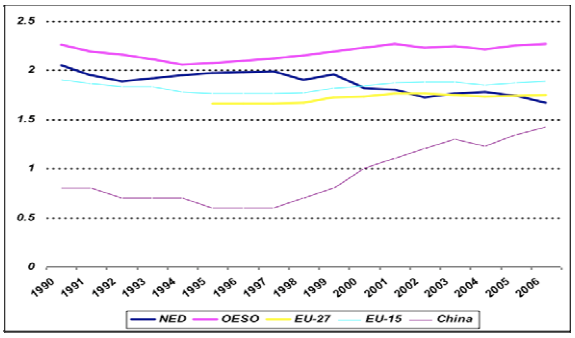


**Figure 1 R&D expenditure based on GDP**

According to China Statistic yearbook of Science and Technology (2007), government has not been a major source of R&D fund. From figure 2 we can see in 2006, only 24.7% of R&D fund was from government; whereas 69.1% was from enterprise and 4.6% from banks, which is comparable with that in 1999, in which the ratio is 32.4%, 34.9%, and 8.8% respectively. A report from Economist on Dec. 20, 2008 said that China is now close to surpassing Japan in total research spending, from almost nothing a decade ago; and corporate R&D in China has soared 23% comparing with 1-2% between 2001 and 2006 in America and Europe. The changes in the source of R&D investment imply that Chinese enterprises have intentionally started to build up absorptive capacity.

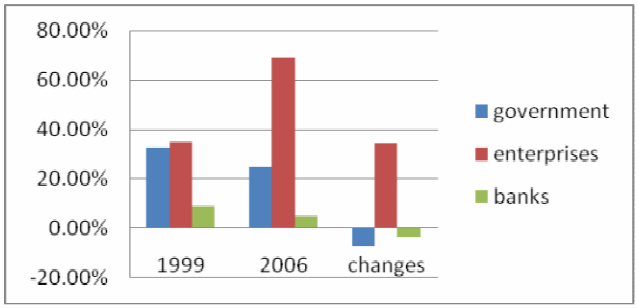


**Figure 2 the funding source of R&D investment**

With respect to the distribution of R&D expenditure, the data from China Statistic Yearbook of Science and Technology (2007) reflects that 71% of R&D funds were allocated to enterprises and 18.9% to domestic research institutes and universities. Since public research institutes & universities in China are closely technological collaborating with enterprises, it is sensible that part of R&D investment by enterprises was spent in the university-industry collaborative R&D projects.

### *3.2 Chinese firms' catching up strategies*

At national level, absorptive capacity can be developed through many channels, of which the most attractive and well researched is foreign direct investment (De Mello, 1997; Dunning, 1993). Studies on this topic have offered many empirical evidences, showing that FDI is an important vehicle for technology transfer and contributing to host countries' economic growth (Borenszein et.al, 1998; Reichert and Weinhold, 2001).

The important role of Multinational Enterprises (MNEs) in host countries is that technologies can be transferred not only through linkage between MNEs and their subsidies in the host country[2], but also through knowledge spillovers via inter-organization cooperation. Through labor turnover, competition force, demonstration effect, and forward as well as backward linkages, FDI could undoubtedly be used at the pre-catching up stage to establish a minimal level of absorptive capacity for host country firms.

[2] mainly determined by the absorptive capacity of MNE's subsidies in host country and the willingness of their parent company to take technology transfer.

Table 1 presents the conclusive characteristics and strategies applied at each stage of catching up by backward country firms. In addition to absorptive capacity, knowledge accumulation at each stage is also notified. It is clear that as catching up proceeds, strategies used for acquiring external technologies evolve as well.

In China, since 1978 when open-door economic reform was initiated, FDI has been acknowledged as the main mode to accelerate Chinese economy growth. The underlying argument concerns that the MNEs' entries have a forcement effect on Chinese local companies. On the one hand, local companies that could not shoulder competition pressure from foreign rivals were firstly displaced[3]. On the other hand, the survival indigenous companies which can survive were forced to improve absorptive capacity via inter-firm cooperation (such as forward and backward linkage in FDI). Many local multinational enterprises such as Changhong, Huawei, Haier, Lenovo, and Galanz et al. surviving at that time had significantly benefited from cooperating with foreign enterprises. Therefore, we argue that *the effect of FDI is inter-dependent on the corresponding inter-firm collaborations.*

As indicated in table 1, catching up country has a variety of choices to enhance absorptive capacity. At different stages, absorptive capacity could be developed through an integrative mechanism where national actors complement each other. In other words by taking China as an example, numerous strategies are implemented at the same time by national actors. Firms that have already been relatively technological advanced are preferable to implementing less committed governance modes such as R&D agreement and strategic alliances. Firms that sit behind are on the contrary feel security to rely on stronger ties forming a valid and high committed governance mode, i.e. merger and acquisitions, or joint ventures. At a firm level, each Chinese enterprise has its own learning network with a number of learning partners and learning modes. Firms that can manage its network well and actively play as a network hub or cover network structure hole are able to preemptively grasp technical knowledge and market.

**Table 1 Strategies used in different stages of catching up**

| Economic Growth Stage | Absorptive Capacity | Economies' characteristic | Strategies to accumulate knowledge | Level of knowledge accumulation |
|---|---|---|---|---|
| Pre-catching up | Very low but might be increasing | Resource-based; Unskilled labor; Low level of inward technology transfer | Low level of Inward FDI and no outward FDI | Low but might be increasing |
| Catching up | Increasing to reach peak | Knowledge infrastructure and domestic industrial capacity; high rate of knowledge accumulation and absorption of external knowledge | Assimilation of spillovers from trade or inward FDI; Technology licensing; reverse engineering (early stage) and R&D (late stage);acquisition of technology by M&A | Rapidly increasing |
| Pre-frontier | declining | Assimilation becomes difficult; marginal return of absorptive capacity declining. | Strategic alliances; in-house R&D; outward FDI; joint venture | Increasing rate decline and reaching the flat range |

Network leader in Chinese catching up networks are identified having a number of common traits. For instance, they either posit the important interfaces across different sub-network as a broker or connect with almost all the other actors as a center. The involved actors in network include profit-oriented firms, universities & institutes, and western companies doing business in China. Based on the observation on Chinese context, we therefore have

***Proposition 1****: firms that embrace higher volume of network resource have higher probability to access a variety of knowledge and markets.*

***Proposition 2****: firms that locate in network center have higher probability to catch up successfully.*

We give the proof of these two propositions in section 4 by studying a case of Huawei Technologies Co. Ltd.

[3] This happened in the late 1980s till mid of 1990. Some state-owned-enterprise that did not endow capability to shoulder the competitive stress went into bankrupt.

## 4. Case study of Huawei Technologies Co. Ltd.

In principle, success in catching up is labeled by the increased marketing performance and raised innovative capability. In this section, an integrative strategy package will be illustrated to see why some Chinese firms could be successful in the international market and how could they ladder quickly to the upper stages. We will take the experience of Huawei Technologies Co. Ltd. as an example and specifically analyze the strategies for developing absorptive capacity and innovation performance.

Huawei is a Chinese company in ICT industry. It is the largest and most prestigious networking and telecommunications equipment supplier in China. Huawei has now had eight overseas regional departments and 85 branch offices around the world. Its industrial status in ICT industry is equal to many multinational companies from western countries.

Huawei's business includes manufacturing and supplying CDMA, 3G terminals, intelligent optical network ASON, core routers, and switching in the world. To help readers have more familiarity with Huawei, we list part of Huawei's recent marketing performance as below[4].

- Huawei's WCDMA products have won business application in 26 countries and regions, including Netherlands, United Arab Emirates, HKSAR, Mauritius, and Malaysia (Ditterner, 2005).
- Huawei's 75% of sales were from overseas market and by 2005 Huawei ranks No.2 in the global market in respect of optical network and DWDM products (Ovum-RHK, 2005).
- Sales amount of Huawei's softswitch products rank No. 1 in the world (Ditterner, 2005).
- Intelligent NetworkHuawei has the most subscribers around the world in this field (Ovum-RHK, 2005)
- Huawei's IP DSLAM products rank No.1 in the global market (Infonetics, 2005 Q2).
- Sales amount of Huawei's MSAN products also ranks No. 1 in the global market (Source: Infonetics, 1H05)
- Huawei's routers rank No.3 in the global router market (Gartner, 2005 Q2)
- Huawei is the global WCDMA network priority suppliers of Vodafone
- Huawei is the global cooperative partner in WCDMA and broadband equipment
- Huawei undertakes the largest NGN network of Germany

To estimate Huawei's innovation performance, we collected patent data from SIPO, USPTO, and EPO, as the performance in USPTO and EPO can represent Huawei's innovative power in developed regions; and patents in SIPO either in English or Chinese can reflect Huawei's competitive capability of innovation performance within China's domestic market. The data from other countries patent databases was not collected, even though Huawei has been recognized and awarded by World Intellectual Property Organization (WIPO) in 2009 as the World's Top International Patent Seeker (which ended the almost one decades of domination by Netherlands' Philips Electronics as the first place on the list).

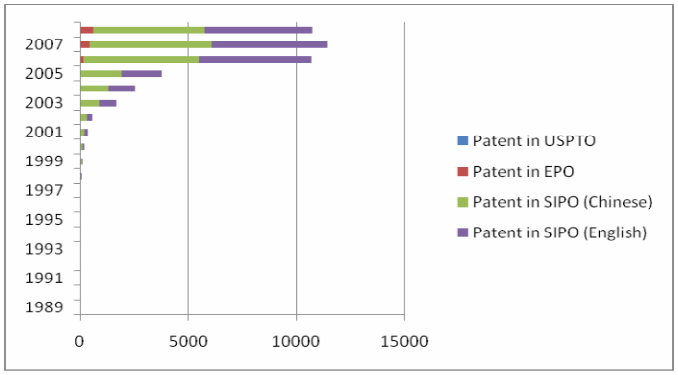


**Figure 3 Huawei's patents in USPTO, EPO, and SIPO**
*Source: USPTO, EPO, and SIPO; collected by author*

Based on the data collected, we drew the picture in figure 3. Since the number of patents is usually considered as an important indicator of firm's innovation performance, we can see that Huawei's innovative capability primarily emerged in 1998 and its marginal increase rate was really high from 2000. In China's domestic market, English

[4]All these information has been collected in <<Shenzhen Company Profiles>> www.torinowireless.it/download.php?fileID=187&lang=it

versioned SIPO patents are specially used to defend from foreign competitors. Figure 3 shows that Huawei worked also hard in China's competitive '*domestic international market'*. Despite the number of patents applied in USPTO is too small to be recognized in figure 3, if just considering the proportion of patents applied in USPTO by Huawei over the whole number of Chinese patents in USPTO each year, we can have conclusion that almost 16% of Chinese patents applied in USPTO each year were accounted by Huawei. Moreover, more patents assigning to Huawei in Europe than that in USPTO implies that Huawei has larger market share in Europe than in U.S. From both marketing and innovation performance perspectives, Huawei's catching up performed successfully.

In order to have thoroughly logical analysis, let us go through with Huawei's history. Huawei was established by Ren Zhengfei in 1988 in Shenzhen, Guangdong province, China. Initially it was just a small distributor of imported PBX products without any telecommunication knowledge. Five years later, in 1993, Huawei had achieved its primary threshold of knowledge accumulation on PBX and successfully made the first breakthrough in C&C08 digital telephone switch by effectively taking advantage of the technology diffusions from Shanghai Bell (the first Sino-foreign joint venture in China). Huawei thereafter successfully monopolized Chinese rural market and small cities. Afterwards, with higher product quality and improved product development, Huawei started to compete with foreign enterprises in Chinese urban market.

As its expertise in networking products, Huawei is also a *network operator* in the industry. Its network strategy made it benefit not only in normal time but also in the economic crisis. Since the beginning of 2008 when global economic crisis started, Huawei's sales has never stopped increasing, even more than 46% up from 2007, reaching USD23.3billion in 2008. After 20 years' continuous development, today's Huawei has been recognized by Business Week as the 3rd World's Most Influential Company (following after Apply and Google).

But how did Huawei achieve this performance? Simply speaking, Huawei's success was owed to the close partnership with different players in the different sectors and regions. The primary decision made by Ren Zhengfei in 1990s to work with Shanghai Bell (which was actually the technology centre in communication sector in 1990s in China) and the Centre for Information Technology (CIT) brought Huawei much more technological knowledge and helped it finish a technological stage-skipping in telecommunication sector. We stress that the effect of FDI comes into effect on Chinese indigenous firms' performance only if strategic alliances involved by Chinese firms can be established beforehand.

In order to avoid direct competition with Shanghai Bell in 1990s, Huawei explored rural market with political support from Chinese government. Getting trust from government means that Huawei was not only able to receive much more privilege in China's domestic market, but also having more financial credits for R&D fund. In 1994, Huawei became the first Chinese firm that established long distance transmission equipment business, launching HONET integrated access network and SDH product line.

By 1996, Huawei had monopolized China's rural regions and part of urban areas. Since then, Huawei started to extend market to overseas by using the similar marketing strategy called "from developing to developed regions". Huawei firstly accessed to backward market that foreign multinationals did not intensively invest (for instance, South Africa, south-east Asia, and South America) and gradually penetrated to developed countries. By keeping collaboration with Chinese universities, Huawei step by step competed with foreign multinational companies also in overseas market. In 1997, Huawei successfully released its GSM products and eventually expanded to offer CDMA and UMTS, which was at that time considered impossible for developing country' firms.

In order to develop management skills and structure, Huawei invested in collaboration with IBM Consultant. Since 1998, this collaboration optimized Huawei's management, organization, and product development structure. Quite fast, Huawei became a leading player in the telecommunication industry by providing diversified products ranging from switching, integrated access network, NGN, xDSL, optical transpot, intelligent network, GSM, GPRS, EDGE, W_CDMA, CDMA2000 as well as a full series of routers, and other LAN equipment.

Besides catching up in management, Huawei invested heavily in Research and Development. Averagely each year, at least 10 % of annual sales were put into R&D for developing absorptive capacity. Huawei so far has established 14 R&D centers around the world, being embedded in the collaboration with suppliers, customers, universities, and leading players. Huawei's alliance-based network is characterized by multidiscipline, multi-level, and multiregions. Table 2 lists Huawei's partnership history with leading players, from which we identify that firstly, Huawei's alliances activities started very early even when it was just founded; Secondly, alliances happened frequently with alliance partners who were not restricted within the same sector; Finally, alliances network enlarged and embedded quickly, by which Huawei gained a list of partners to work with in a stable way.

As what Huawei people declared, they aim to be *abreast with the latest technology and quickly incorporate advanced technology into its own knowledge base.* Huawei people believe that the cooperation with leading multinational companies can help them *enlarge technology base and achieve win-win outcome*. Therefore, since 1997, Huawei have established joint ventures (1) with Siemens on the research, production, sales, and services of

TD-SCDMA in order to further advance its technology development; (2) with Motorola in Shanghai to engage in providing global customers with powerful UMTS products, solutions, and HSPA; (3)with many prestigious companies such as Intel, Texas Instruments, Freescales Semiconductor, Qualcomm, Infineon, Agere Systems, Microsoft, IBM, Sun Microsystems HP, ADI, Altera, Motorola, Oracle, SUN, TI, and Xilinx for a number of joint laboratories; (4) with many other world leading management consultant companies such as Hay Group, PwC, and FhG to introduce a series of advanced processes such as IPD (Integrated Product Development), ISC (Integrated Supply Chain), IT-based management system in human resource management, financial management, and quality control.

Figure 4 shows that technological alliances with foreign firms are classified into three groups: with Japanese, American, and European enterprises. Of there, thirty-six per cent inter-firm alliances were conducted with American firms; forty-three were focused with European enterprises; and twenty-one per cent alliances were happened with Japanese companies. The regional distribution of Huawei-foreign alliances indicates that Huawei's strategic alliances are intended to be with advanced countries firms that embrace relatively high industry reputation, lager technology base, and embedded collaboration networks. If we consider further to check the network position of Huawei's alliances partners in the corresponding region/sector, we can find that all of them are absolutely holding the cluster center. This means that Huawei's strategy to work with them is beneficial for it as a network broker accessing a larger network resource from other clusters.

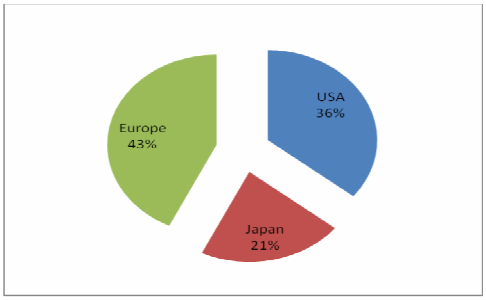


**Figure 4 Regional Distribution of Huawei-foreign Alliances**

Besides dyadic alliances, Huawei is actively working on numerous promising technology networks. In May 2006, Huawei was invited to join the SCOPE Alliance Network and committed to support SCOPE's mission of enabling and promoting the availability and interoperability of open carrier grid base platforms. In Dec. 2008, Huawei entered into the Open Handset Alliance Network and planned to launch smart phones based on the Android platform in 2009. In Feb. 2009, Huawei was invited to participate Open Patent Alliance (OPA), which is a group formed in June 2008 by members of the WiMAX ecosystem such as Alcatel-Luucent, Cisco, Clearwire, Intel, and Samsung Electronics, aiming to form a WiMAX patent pool and aggregate patent rights to implement the WiMAX standard. Huawei's participation was derived from its significant contribution to development of OFDM & MIMO broadband wireless technologies. As the vice president of Wireless product line and president of CDMA & WiMAX product line of Huawei said, Huawei's joining OPA will ultimately promote Huawei to offer broader choice and lower TCO for WiMAX technology and also will help them deliver more products with high quality around the world at affordable prices[5].

**Table2 The Memo of Huawei's Alliances (1989-present)**

| Announced Date (mm/dd//yy) | Name of Partners | Partner Nation | Joint Venture Flag |
|---|---|---|---|
| 1989-1994 | Shanghai Bell Telephone Manufacturing Company (BTM)<br>Huawei Technologies Co Ltd | Sino-U.S. JV<br>China | No |
| 02/20/97 | Huawei Technologies Co Ltd<br>Texas Instruments | China<br>USA | No |

[5] Refer to Huawei's global website http://www.huawei.com

| | | | |
|---|---|---|---|
| 04/09/97 | BETO<br>TELEKOM<br>Huawei Technologies Co Ltd | Russian Fed<br>Russian Fed<br>China | Yes |
| 08/26/99 | Huawei Technologies Co Ltd<br>Fujian Provincial Mobile | China<br>China | No |
| 06/08/00 | Huawei Technologies Co Ltd<br>QUALCOMM Inc | China<br>USA | No |
| 11/27/01 | NEC Corp<br>Matsushita Commun Industrial<br>Huawei Technologies Co Ltd | Japan<br>Japan<br>China | Yes |
| 10/21/02 | Huawei Technologies Co Ltd<br>Agere System | China<br>USA | No |
| 10/21/02 | Huawei Technologies Co Ltd<br>Microsoft | China<br>USA | Joint lab |
| 10/23/02 | Huawei Technologies Co Ltd<br>NEC Corp | China<br>Japan | Yes |
| 03/19/03 | 3Com Corp<br>Huawei Technologies Co Ltd | USA<br>China | Yes |
| 06/04/03 | Avici Systems Inc<br>Huawei Technologies Co Ltd | USA<br>China | No |
| 08/29/03 | Huawei Technologies Co Ltd<br>Siemens Info & Commun Mobile | China<br>Germany | Yes |
| 09/16/03 | Huawei Technologies Co Ltd<br>Infineon Technologies AG | China<br>Germany | No |
| 02/12/04 | Information & Communication Mo<br>Huawei Technologies Co Ltd | Germany<br>China | Yes |
| 04/25/05 | Huawei Technologies Co Ltd<br>Intel | China<br>USA | No |
| 03/02/06 | Huawei Technologies Co Ltd<br>HP | China<br>USA | No |
| 05/31/06 | Huawei<br>Freescale Semiconductor | China<br>USA | No |
| 07/25/06 | Motorola Inc<br>Huawei Technologies Co Ltd | USA<br>China | Yes |
| 02/13/07 | Huawei Technologies Co Ltd<br>Qualcomm Inc. | China<br>USA | No |
| 05/14/07 | Huawei Technologies Co Ltd<br>Global Marine Systems Ltd | China<br>United Kingdom | Yes |
| 05/21/07 | Huawei Technologies Co Ltd<br>Symantec Corp | China<br>USA | Yes |
| 10/31/07 | Huawei Technologies Co Ltd<br>International Telecommunication Union | China<br>Internationa l Institute | No |
| 1998-2003 | Huawei Technologies Co Ltd<br>IBM | China<br>USA | Consultant Agreement |
| 12/12/08 | Huawei Technologies Co Ltd<br>Microsoft | China<br>USA | No |
| 03/20/09 | Huawei Technologies Co Ltd<br>Infineon | China<br>Germany | No |
| 08/09/09<br>01/01/01 | Huawei Technologies Co Ltd<br>Sun Microsystems Inc. | China<br>USA | Telecom Lab |
| 1997-Now | Huawei Technologies Co Ltd<br>Hay Group | China<br>USA | Consultant agreement |
| 1997-Now | Huawei Technologies Co Ltd | China | Consultant |

| | | | |
|---|---|---|---|
| | PwC | Britain | Agreement |
| 1997-Now | Huawei Technologies Co Ltd<br>FhG | China<br>USA | Consultant<br>Agreement |

*Source: SDC database and various media announcement.*
*Note: the alliances partners appeared above are mostly Huawei's long-term collaborators. Despite some of them have been competitors, the dyadic alliances are still continuing and partnership is natured of stability and repeatability.*

In line with allying with leading players, Huawei never stopped research alliances with universities. So far, Huawei has been building *advanced research labs* with more than 20 Chinese domestic research institutes and universities such as Beijing University (since Nov. 2005), Zhongshan University, China (since Dec. 2008), Zhejiang University, China (since March, 2008), Tsinghua University, China (since Jan. 2007), University of Science and Technology of China (since April, 2009), Xi Dian University, China (since Dec. 2007), Sanjiang Unversity, China (since Sept, 2007), Northwest Polytechnical University, China (since Oct. 2004) etc.

Moreover, more than 10 joint training programs with Chinese universities in different regions were founded, namely 'Huawei High Level Talented-Person Cultivation Base' (Huawei Rencai Pei Yang Ji Di). These joint programs are purposive to provide Chinese graduates with pre-career education. Huawei treated universities and institutes as its *knowledge incubator* because it has been proved to offer Huawei much more benefits than expected. In recent years, Huawei extended investment on technological alliances to a number of foreign universities such as INATEL University, Brazil (since Sept. 2003) and Shrif University, Iran (since July, 2009).

In order to find a short-cut solution for standardization of technical training in China's ICT sector, Huawei established Huawei University in 2005. This university has seven University Subsidiaries located across China (in Beijing, Xi'an, Nanjing, Hangzhou, Chongqing, Kunming, and Kuilin). It is aimed to enhance the intra-sector communication and offer the best training for ICT players in China. Technological engineers and managers from each ICT firm are welcomed. In order to catch up the international training standard, Huawei University invested dramatically on hiring professional researchers domestically and abroad. Unlike alliances with other firms, Huawei University not only offered a springboard for China's ICT sector to develop absorptive capacity interactively, but also enhanced Huawei's reputation. The exchanged information/technology intra China's ICT sector was thereafter blooming out; and Huawei certainly becomes the 'Knowledge Hub' of ICT network in China.

Comparing with technological alliances, Merger and Acquisitions (M&As) were not implemented quite often by Huawei. Table 3 lists M&As activities involving Huawei from 1989. From that we can see Huawei's activities in acquisition started just from recent years and they were mainly located in China's domestic market or backward countries. This implies that M&As was not a priority of governance mode for Huawei in absorbing technology/knowledge. In contrast, it was a short-cut way to dominant low-income market.

Therefore, strategic alliances are the priority strategy that Huawei used to absorb external knowledge. The universities-involved network facilitated Huawei to grab human capital preemptively[6] and efficiently digest frontier technology as well. Because a number of top Chinese universities have cooperation with foreign universities, Huawei benefits a lot in term of knowledge diffusion. Huawei could hear the latest research result raised in academy field and from this point universities are also acting Huawei's *listening ear*.

Also, Huawei's partnership history indicates that Chinese firms can shorten catching up process by using alliances-based network. Unlike the widely acceptable catching-up model in which latecomers go through OEM, ODM, and OBM (i.e. Lee and Lim, 2001), Huawei's technological catching-up is characteristic of stage-skipping[7]. By going through *replicable imitation stage, innovative imitation stage, and self-innovation step* within 20 years, Huawei maintains its own brand. To build up *the basic knowledge base*, Huawei insists on close collaboration with local universities and research institutes. It can be identified that Huawei's initial success is attributed to a large alliance-based network; and only if the R&D collaboration with universities is executed, alliances with leading players could become 'a cherry on the cake'.

Moreover, Huawei's strategy in choosing network positions could not be ignored, because the network position determines the orientation of knowledge flow. Huawei's concentrative working on alliance-based network with universities and leading players has offered itself continuously upgraded network position as well as high reputation.

[6] Unlike other foreign MNEs strategies in attracting excellent graduates[6], Huawei, from the beginning, keeps working with universities to nurture the pre-graduates; it even set up the Huawei training centers in many universities. The excellent graduates are attracted there, not only because the average salary per year offered to graduates is relatively higher than that by foreign MNEs, but also because the rich program of training are provided each year.

[7] Huawei did not picked up the analogue electronic switch technology as a basic level, but rather smartly jumping to the most popular technologies taken by foreign companies at that time---the digital electronic switch technology

Today, Huawei has not been that small firm without any market influence as 20 year ago; in contrast, it has been no questionably considered as a central actor in China's ICT sector network.

The miracle changes of Huawei's position implicate that Huawei's strategy for developing network power is really effective. In the international market, Huawei plays as a strong competitor with multinational companies such as Cisco System and Alcatel-Lucent etc. also as a humble learner from them. Encompassing a double-face identity (contributor as well as learner) gave benefits to Huawei that many competitors are more likely to invite it attending technology-based networks for research and patent sharing.

Figure 5 presents Huawei's strategy in alliance-based network. Except Huawei that located in the centre of figure 5, five groups of actors play in this network, which include western multinational companies (WMNC), western countries' universities (WU), Chinese universities (CU), Chinese domestic companies (CC), and companies with low performance but high technology base either in China or overseas (LC). From the case study above, we can see Huawei attracted knowledge/technology inflow through a large number of stable direct connections with western multinational companies and Chinese universities. Moreover, in case of collaboration that happened between other Chinese firms and Chinese universities, Huawei absorbed knowledge diffusion *indirectly* through knowledge spillovers. This was similar in the cases between western multinational companies and western universities. Through direct collaborations with Chinese universities and western firms, the technology produced by western universities could be reached *indirectly*. On the one hand, Huawei extends knowledge acquisition via Chinese universities; on the other hand, Huawei keeps effort on speeding up indirect knowledge diffusion. The data from Huawei's global website indicates that so far more than 30 R&D subsidiaries have been set up in Western Europe and North America and more than 75% of researchers are hired from local places.

Moreover, knowledge inflow could also be derived from acquisitions in developed and developing nations, or domestic market. Even though there were not too many acquisition cases related to Huawei, Huawei's motivation on acquisitions is very clear. We say that to promote its network position and enhance absorptive capabilities, Huawei's action in acquiring target firms that contained high volume of technology but performed inefficiently due to dead management or blocked financial supply can be motivated.

**Table 3 Huawei M&As (1989-2008)**

| Announced Date (mm/dd/yy) | Target Name | Target Industry Sector | Target Nation | Acquirer Name | Acquirer Industry Sector | Acquirer Nation |
|---|---|---|---|---|---|---|
| 10/28/05 | Huawei-3com Co Ltd | Prepackaged Software | China | 3Com Corp | Computer and Office Equipment | United States |
| 11/03/05 | Huawei Technologies-South | Business Services | South Africa | Nulane Investments | Business Services | South Africa |
| 11/07/05 | Huawei Electronics Co Ltd | Chemicals and Allied Products | China | Henkel AG & Co KGaA | Soaps, Cosmetics, and Personal-Care Products | Germany |
| 11/15/06 | Huawei-3com Co Ltd | Prepackaged Software | China | 3Com Corp | Computer and Office Equipment | United States |
| | | | | | | |
| 03/19/03 | 3Com Corp-Assets | Prepackaged Software | China | Huawei Tech-Entrp Bus Asts | Communications Equipment | China |
| 02/08/04 | SUNDAY Communications Ltd | Telecommunications | Hong Kong | Huawei Technologies Co Ltd | Communications Equipment | China |
| 08/08/05 | Marconi Corp PLC | Communications Equipment | United Kingdom | Huawei Technologies Co Ltd | Communications Equipment | China |
| 06/07/06 | Harbour Networks Hldg-Assets | Prepackaged Software | China | Huawei Technologies Co Ltd | Communications Equipment | China |
| 06/23/06 | Intercellular Nigeria Ltd | Telecommunications | Nigeria | Huawei Technologies Co Ltd | Communications Equipment | China |
| 10/26/07 | Shanxi Huashang Media Grp Co | Advertising Services | China | Huawen Media Investment Corp | Wholesale Trade-Nondurable Goods | China |

*Source: SDC database and collected by author*

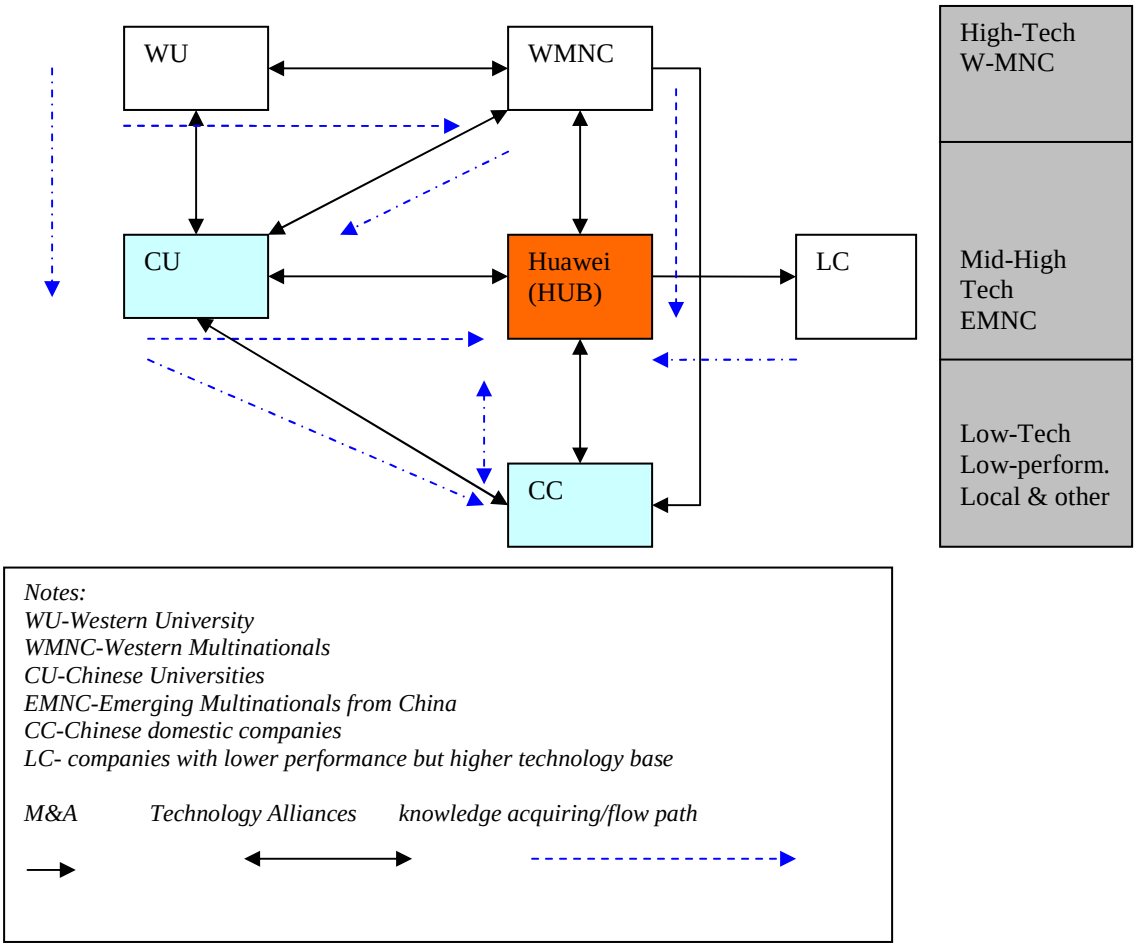


**Figure 5 Huawei's strategy in alliance-based network**

## 5. Conclusion

Due to the research gap in previous studies on Chinese firms' catching up from alliance-based network perspective, this study is aimed to find out the root causes of Chinese firms' rapid development. The presentation of a case study on Huawei Technologies Co.Ltd. indicates that alliances-based network is an efficient mode for Chinese firms to shorten catching up path. Departing from previous studies that interpret Chinese firms' development through FDI and government policy, this study not only highlights FDI's positive impact on Chinese firm's development, but also more importantly clarifies the significant role of collaboration network in foreign investment.

By analyzing the case of Huawei Technologies Co.Ltd., two propositions were proved thoroughly. We say that at least in China's context, firms that embrace higher volume of network resource have higher probability to access a variety of knowledge and markets; and firms that locate in network center are more likely to accomplish catching up successfully and quickly.

We argued that for firms aiming to establish a primary base for absorptive capacity, alliances-based network could help to recognize knowledge diffusion at the first moment. We clarified the role of firm's alliances-based network in the whole catching up path and involving actors, and stressed that the triangle shaped alliances cycle with universities and leading players can not only guarantee the network stability but also provide a suitable platform for absorptive capacity development. On the one hand, Chinese firms could establish a primary level of absorptive capacity with technologically working with universities; and on the other hand through alliances with leading players, Chinese firms could be motivated in R&D investment.

Unlike previous studies, we claimed that FDI's impact works through alliances-based network in China. Even though FDI is an effective mode for technology transfer which has been widely received consensus, we claim that it is true only when a firm stays at a pre-catching-up stage where knowledge absorption is passive; once if a firm is

willing to actively absorb knowledge, wherever it stays in the catching up path, alliance-based network is the most effective mode. This is much departing from previous network studies, as combining alliances with universities and firms was not ever highlighted for backward firms. We argue that for backward country firms, universities and counterpart firms are quite necessary to be incorporated into alliances packages, because alliances with universities could significantly *enhance a firm's absorptive capacity in early stage;* and allying with universities as well as firms could facilitate *firm's capability to absorb in the late stage.*

Alliances with partners from different regions are also important. As we claimed before that only if working with universities is executed, working with leading players could possibly become 'a cherry on the cake'. For each Chinese firm, this does work effectively because working with advanced partners could be feasible only if firms have required knowledge base for certain technologies. And of course allying with advanced firms could possibly keep the company being abreast with the latest innovation and technology development, being alert to the competition, and investing in R&D as well as sharing the innovation challenge & risks.

As the contributions of this study, we highlight that this study opened up a new stream of research on emerging economies firms' catching up *from network perspective*. Strategic alliances will not only be an advanced governance mode for developed country firms to speed up new product development, but also an important strategic manner for emerging country firms to rapidly catch up. The case of Huawei proves that strategic alliance-based network is able to enhance firm's absorptive capacity from the very beginning. This case from Chinese firm shows that the pre-alliances with universities would be win-win awarded, as firms' absorptive capacity could be built through technological alliances and universities could receive research fund as a return. We believe that network-stimulated development for backward country firms will be demonstrated as an efficient mode in other national context.

Of course, this study contains several limitations. First, due to the strict permission to access Huawei's intra database, we could not have more detailed information. All the data in this study were collected either from academy databases or media announcement. It is clear that there are still lots of alliances not being incorporated in the academy database. Therefore, we suggest that future studies could pay more attention on first-hand data collections, preferably interviews. Second, this study was conducted upon a single company that has been very successful in China. However, it would be more completed if having more cases on this issue. We suggest that future studies can make comparison on a couple of cases, one firm caught up successfully due to high volume of strategic alliances; the other failed because of weak capability on strategic alliances (maybe due to a small number of alliances, or maybe due to weak alliance capability), so that a more objective judgment upon the impact of alliance-based network on emerging country firms' catching up could be comprehensively presented.

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